

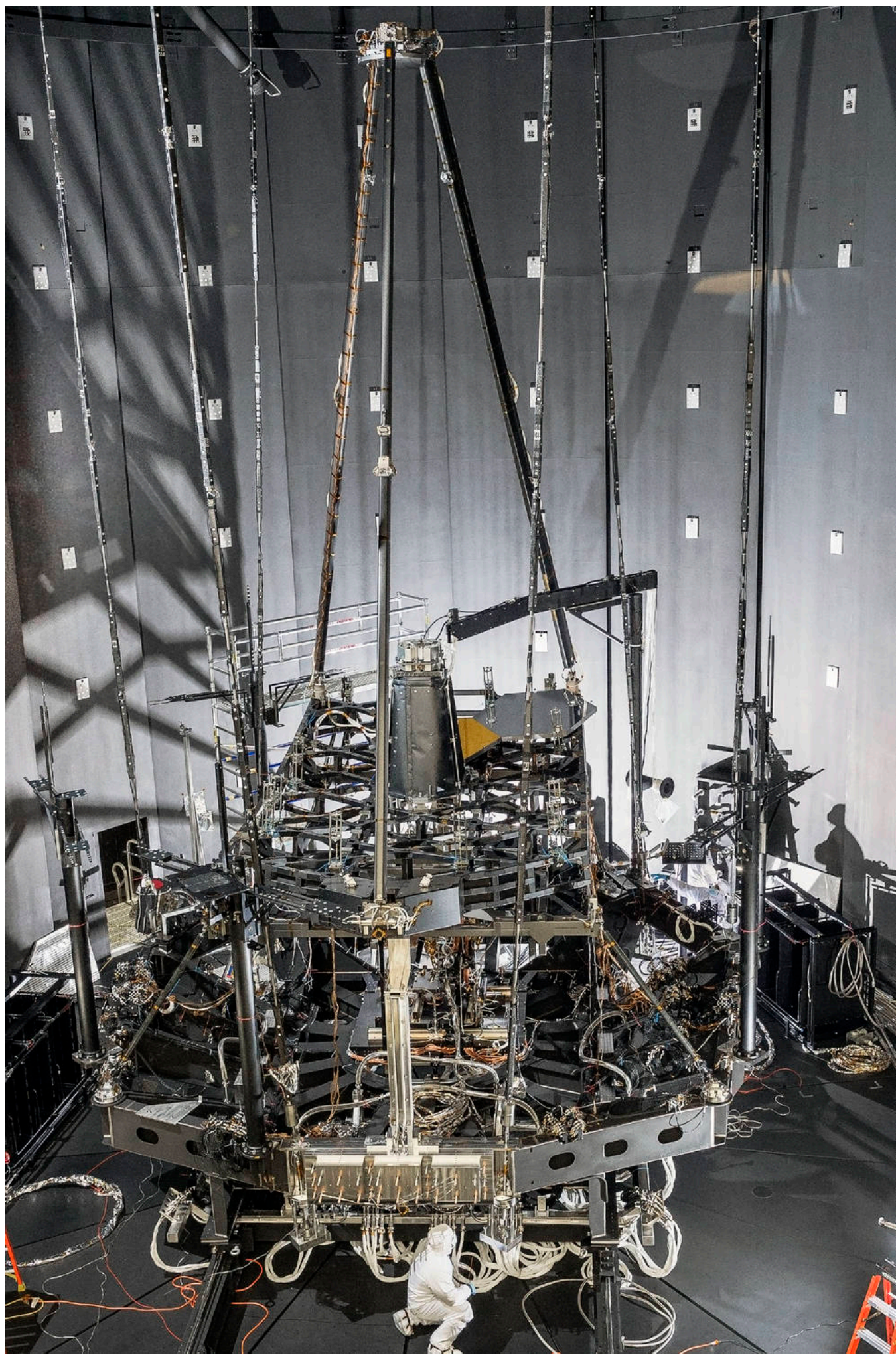


Alignment Test Results of the JWST Pathfinder Telescope Mirrors in the Cryogenic Environment

T. Whitman, C. Wells, J. Hadaway, S. Knight, S. Lunt
Harris Corporation, University of Alabama, Ball Aerospace & Technology Corp.

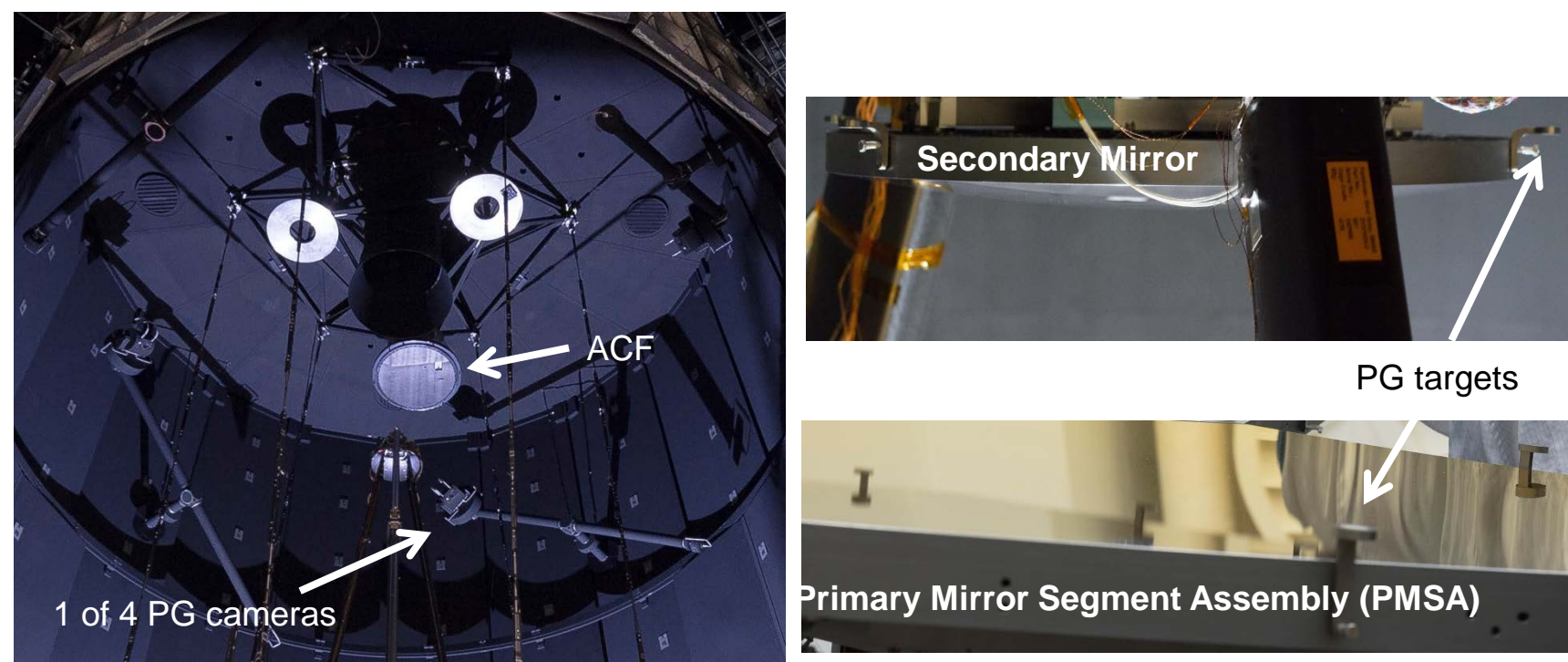


Pathfinder Telescope Cryo Test Configuration



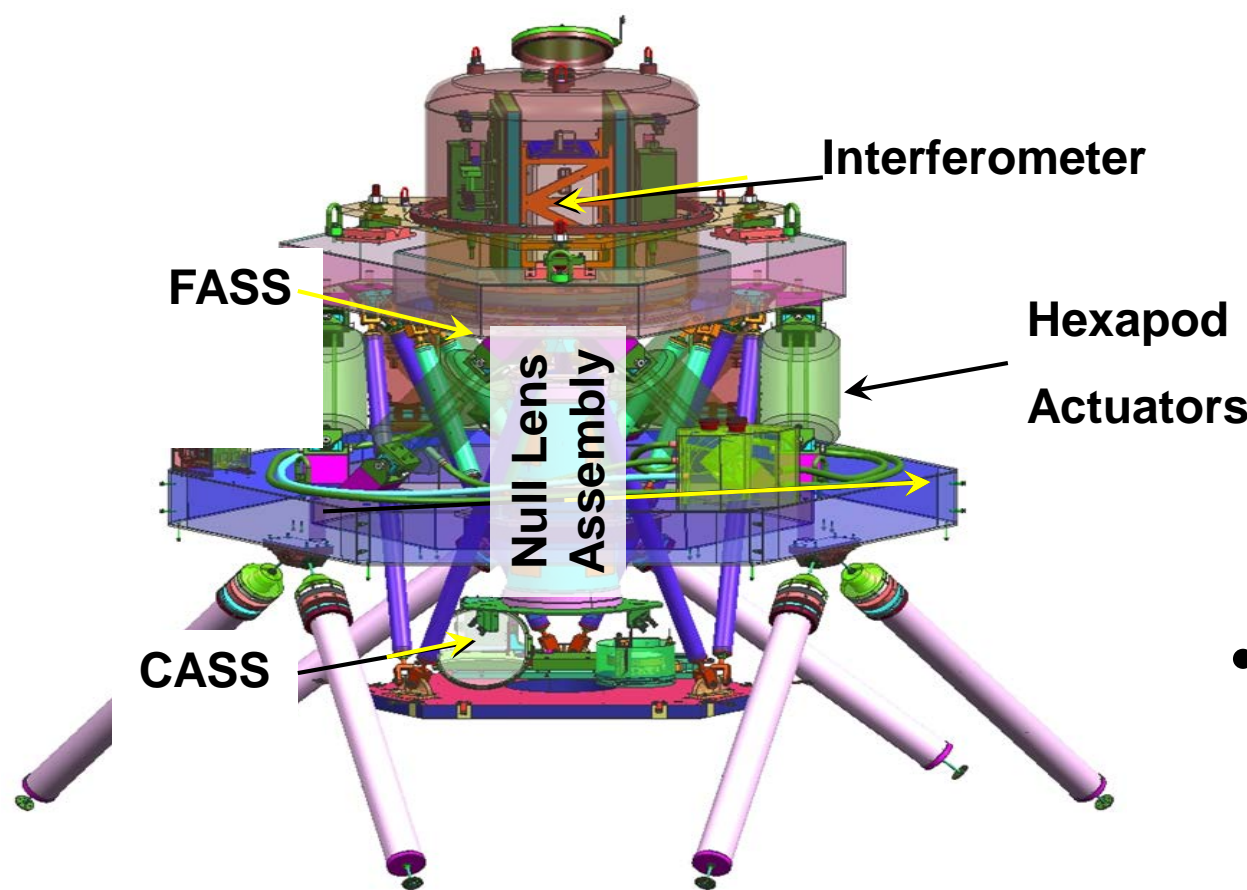
Pathfinder telescope with 2 PMSAs on a center section backplane, an SMA, the AOS, and a detector array on stages below the AOS in the cryogenic test configuration. Point sources above the AOS emit light upward and downward for telescope image testing. JWST will have 18 PMSAs, a backplane with wings and support frame, and the Integrated Science Instrument Module for electronic detection.

A. 4 Photogrammetry (PG) Cameras on Windmills Aligned mirrors to Aft Optics and Point Sources



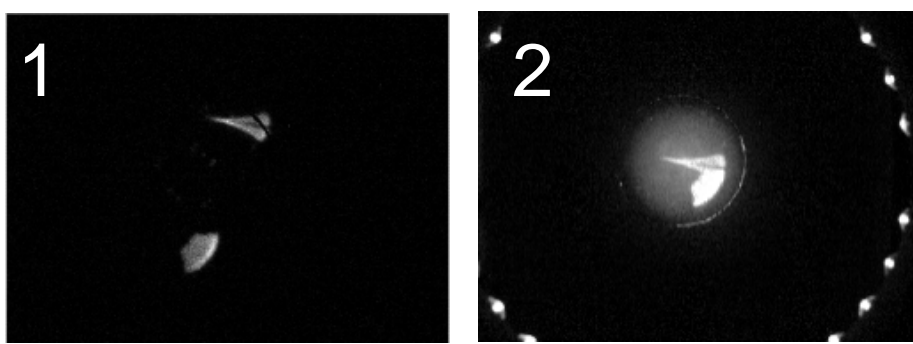
	Degree of freedom	Uncertainty (mm or mrad)
PM - AOS	Piston	0.038
	Decenter	0.084
	Tilt	0.090
	Clocking	0.309
SM - AOS	Piston	0.086
	Decenter	0.652
	Tilt	0.274

B. Alignment of Interferometer to Primary Mirror

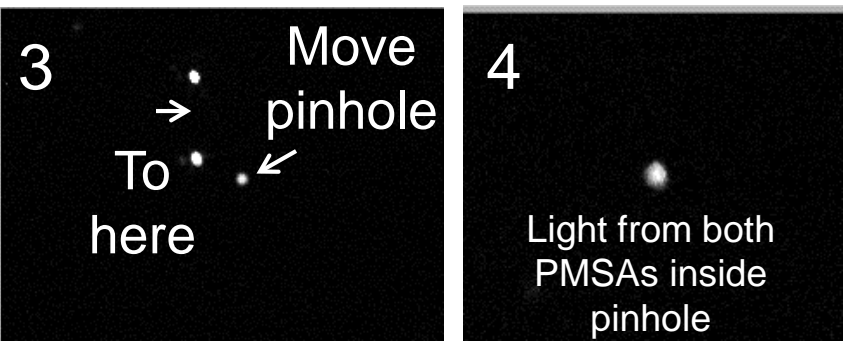


- Center of Curvature optical assembly (CoCOA) with alignment aids and interferometer

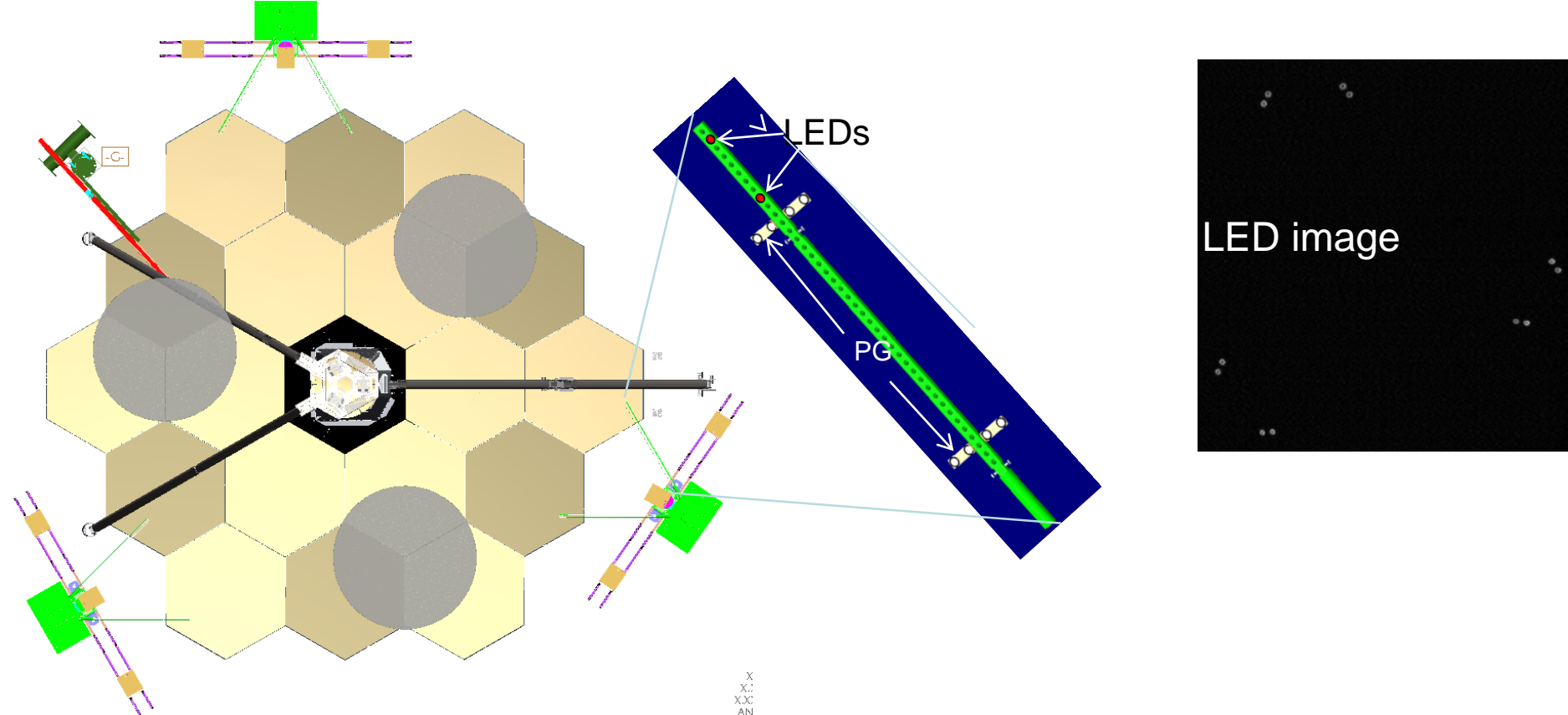
- Hexapod actuators centered Coarse Alignment Subsystem (CASS) images in view
- PMSAs tilted to place return light into Fine Alignment Subsystem (FASS) view



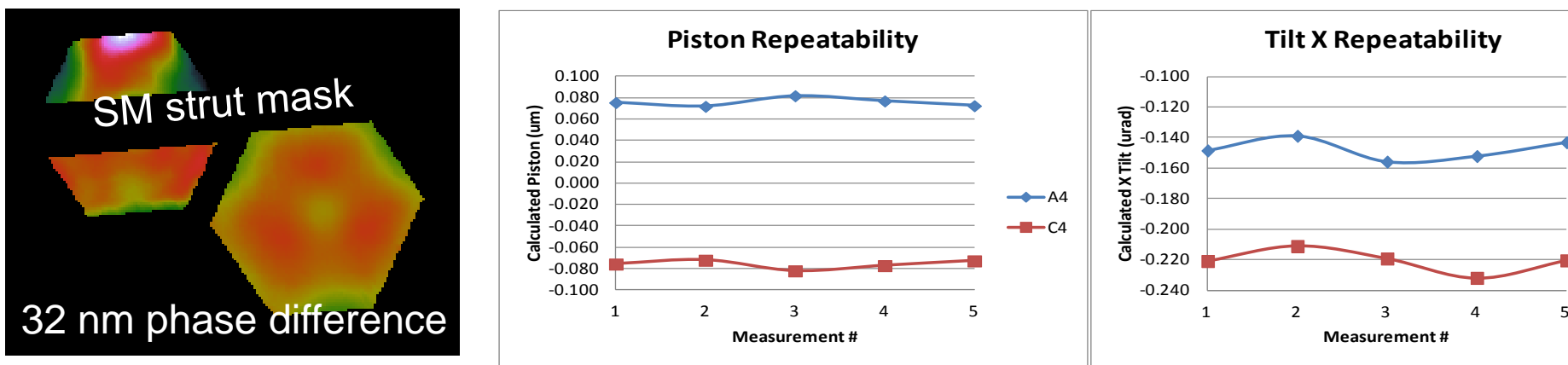
- FASS view from CASS alignment to finely actuate CoCOA position to center pinhole.
- PMSAs tilted to place return light into pinhole for interferometer



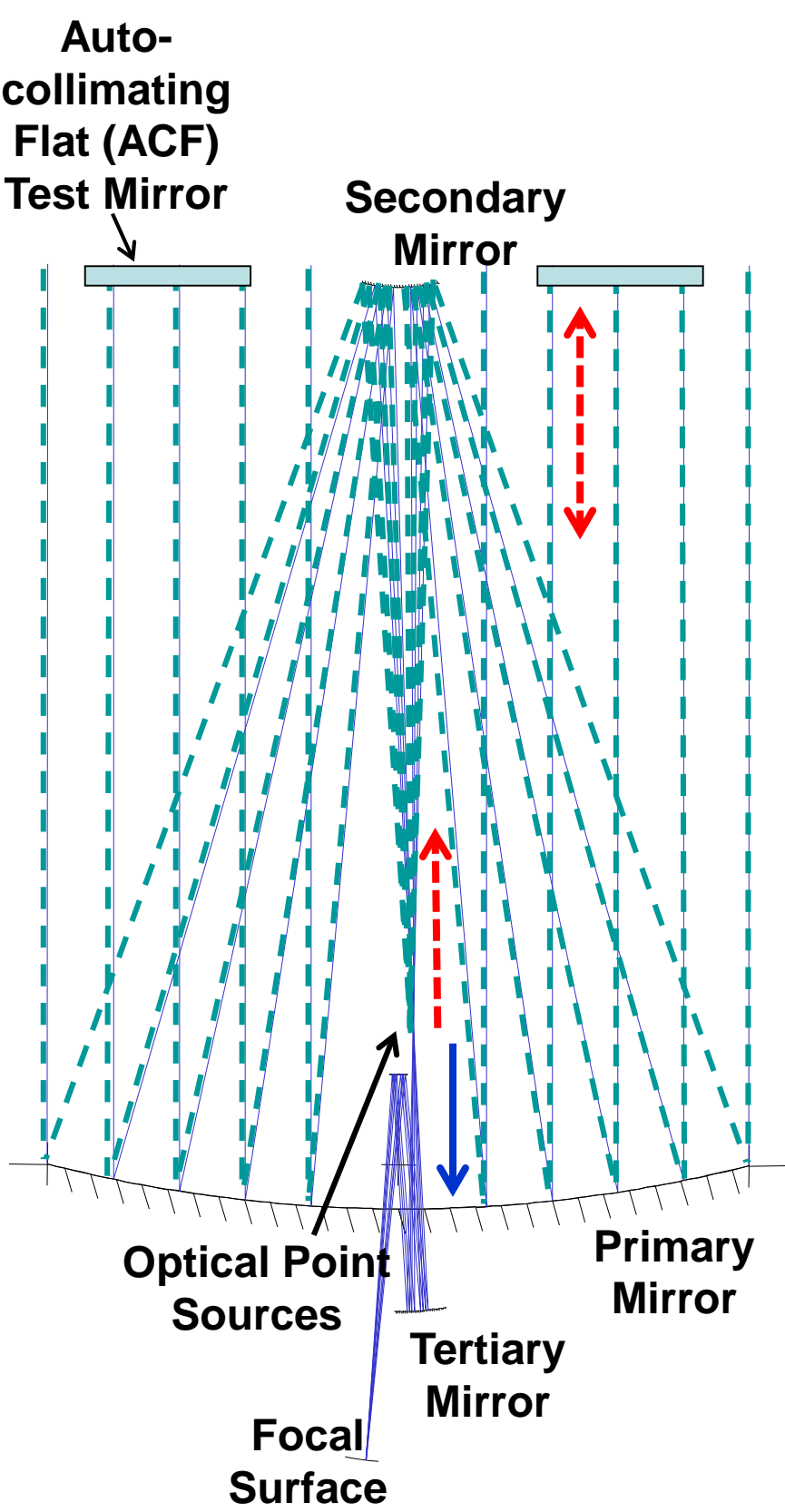
C. Point Interferometer to Center LED Fiducials Down Near Primary Mirror – Repeat B and C as Necessary



D. Phase PMSAs – Repeat A Through D as Necessary¹



E. Focus SM with Image From Point Source



The vibration of the PMSAs were higher than expected, so a new Hartmann-like technique had to be developed to analyze the images that is expected to perform nearly as well as original expectations². Images were captured with the new technique and the analysis method is being developed to assess the images. Meanwhile, the test configuration is undergoing improvements to decrease the vibration and the vibration will be re-evaluated in an upcoming cryogenic test with the Pathfinder³.

References

- Hadaway, J. B., et. al., "Performance of the primary mirror center-of-curvature optical metrology system during cryogenic testing of the JWST Pathfinder Telescope," Proc. SPIE 9904, (2016)
- Knight, J. S., et. al., "Hartmann Test for the James Webb Space Telescope", Proc. SPIE 9904, (2016)
- Matthews, G. W., et. al., "JWST telescope integration and test progress," Proc. SPIE 9904, (2016)